COMMONWEALTH OF AUSTRALIA

DEPARTMENT OF NATIONAL DEVELOPMENT

BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS

Record No. 1968 / 72

Results of Diamond - Drilling in the Dobbyn Area, Queensland 1966

by

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SUMMARY

Eight diamond-drill holes were drilled in the Dobbyn Area, Queensland, in 1966 to test geophysical anomalies found by the Bureau of Mineral Resources in a survey made in 1963 and 1964. Five of the holes were drilled by the BMR, two by Australian Selection (Pty) Ltd, and one by Ausminda Pty Ltd.

The drilling results show that induced polarisation anomalies in the Dobbyn area are due to sulphides. The sulphides are predominantly pyrite, and are uneconomic.

1. INTRODUCTION

In 1966 the Bureau of Mineral Resources (BMR), Australian Selection (Pty) Ltd, and Ausminda Pty Ltd, drilled geophysical anomalies found by the BMR during geophysical surveys made in 1963 and 1964 in the Dobbyn area, about 70 miles north-west of Cloncurry, Queensland. The location of the areas surveyed is shown in Plate 1. The aim of the surveys was to search for copper deposits, particularly in the primary zone. Induced polarisation (IP) and electromagnetic (E.M.) methods proved most useful, though self-potential (S-P) and magnetic methods were also used.

Twelve diamond-drill holes were recommended for initial testing of geophysical anomalies, and eight holes were drilled (see Plates 2, 3, 4, and 5). Between the start of the geophysical work in 1963 and its completion in 1964, most of the survey was taken up in authorities to prospect by Australian Selection (Pty) Ltd, and by Ausminda Pty Ltd. These companies agreed to drill some of the recommended holes on their authorities to prospect. Of the eight holes drilled, Australian Selection (Pty) Ltd drilled two (DDH Nos. 1 and 2) and Ausminda Pty Ltd drilled one (DDH No. 6). Resistance and slef-potential logs were made of six of the holes.

Geologists of Australian Selection (Pty) Ltd supervised most of the BMR's drilling.

The 1963 and 1964 geophysical surveys were reported on by Gardener (1964 and 1965). An aeromagnetic survey of the Mount Cuthbert-Dobbyn area was made by the BMR in 1963 (Dockery and Tipper, 1964). A reconnaissance gravity survey of the area between Kajabbi and Kamileroi was made by the BMR in 1963 and 1964 (Smith, 1966). Further exploration was recommended in the Dobbyn area on the basis of the gravity survey, and this work was carried out in 1967 (Smith, 1968).

2. GEOLOGY

The area drilled is in the Leichhardt Metamorphics. Carter, Brooks and Walker (1961, p. 60) describe the lithology of this formation as essentially highly to moderately metamorphosed acid lavas, with some metamorphosed sediments, metabasalt, and rare tuff. In places the lava, for the most part originally dacite and rhyolite, is migmatised and granitised; elsewhere it has been recrystallised. Associated metamorphics include migmatite, gneiss, mica schist, quartzite, calcsilicate rocks, and hornblende schists and amphibolite which were probably mainly basic igneous intrusives originally.

In the survey area the regional trend is roughly north-south and the dip is steeply east.

The surface geology of the areas drilled was mapped by W. B. Dallwitz (pers. comm.) in 1964 (see Plates 3, 4, and 5). Topographic relief is mostly very low, and bedrock in much of the area is concealed by transported and residual soil and by shallower alluvium. The principal rock-types are acid volcanics and dolerite, and lenses of quartzite are present in places. The dolerite is commonly altered to amphibolite, and in many places it has been converted to biotite schist by metasomatic processes. Secondary changes in the acid volcanics are far less intense and less widespread, and take the form of shearing and sericitisation. The acid volcanics and quartzites form the most prominent outcrops, but in many places even the volcanics are concealed by soil containing quartzite rubble, and by alluvium (information from diamond drilling; extrapolations from outcrops). Areas occupied by dolerite or its derivatives are generally flat or of very low relief, and are commonly completely covered by soil or alluvium; in some places, where soil cover is very shallow, fragments of basic rock are scattered over the surface, and in rare instances nodules of magnesite in soil are clearly indicative of underlying basic rock. Rubble consisting of quartzite, quartz, and acid volcanics is commonly found in transported soils overlying dolerite and related rocks. Minor cross-faults have commonly displaced lenses of quartzite by 50 to 100 feet. Quartz veins are especially prominent in the vicinity of the Dobbyn mine, and they also form hard cores at the crests of quartzite ridges elsewhere.

Signs of compositional layering noted in dolerite and amphibolite in some of the diamond-drill cores suggest that the dolerite was intruded as lenticular and branching sills into a more or less flat-lying sequence consisting of acid volcanics and minor interbedded lenses of quartzite. After intrusion of the dolerite, the rocks were isoclinally folded, and the dolerites especially were strongly sheared and metasomatically altered in places. A massive dolerite dyke up to 200 feet wide was intruded into biotite schist and amphibolite in the northern part of the area; it lies a short distance to the east of the Copperless lode, has chilled contacts, trends almost due north-south, and shows no sign of shearing either in surface outcrops or in diamond-drill cores.

Pyrite and chalcopyrite mineralsiation is found mainly in amphibolite and biotite schist, but it also occurs in acid volcanics, generally, but not necessarily (see DDH No. 10) near their contacts with amphibolite and schist. Mineralisation closely follows the schistosity which nearly everywhere dips steeply (70^{o} to 80^{o} or more) to the east, though a few westerly dips were also noted. At the Kohinoor mine the sulphide mineralisation is associated with a massive grey calcite lode. On the surface, mineralisation is represented by ferruginous quartz veins and gossan, but, except for the siliceous veins, outcrops are extremely rare. The gossans shown on the maps consist almost entirely of ironstone rubble, and the widths indicated on the plans are much greater than any of the actual widths established by drilling. Inferred extensions of the gossans, some of them displaced by faulting, are covered by transported soil containing quartzite and quartz rubble. Extensions of the gossans indicated in Plate 3 are based on IP and E.M. results, and on extrapolated strikes established from gossan rubble. A comparison between Plates 2 and 3 shows that many of the gossans mapped have no anomalies associated with them.

In the vicinity of the Copperless mine (Plate 4) the drilling target appears continuous. Most of this area is covered by soil or alluvium, and boundaries shown are inferred.

Plate 5 shows the geology in the area of the Dobbyn mine.

Detailed geological logs of the drill holes are given in the appendices.

3. METHODS

The IP measurements were made in the frequency domain with dipole-dipole electrode configuration. Induced polarisation is due to chemical or electrochemical processes which take place when current flows from an electrolyte into a metal, or vice versa. Such processes can take place in rocks containing grains of metallic minerals dispersed through the rock, provided these metallic grains are distributed through the rock rather than occurring as continuous filaments; IP is a function of sulphide content, size of the sulphide grains, bulk resistivity of the rock, density, porosity, and various other physical properties of the rock (Keller and Frischknecht, 1966, p.438 and 444-446). Disseminated sulphides produce anomalies comparable with those produced by 'lodes'.

The E.M. method used was Turam, which is one of the fixed source, moving receiver methods. The primary field sources used were straight grounded cables. Turam anomalies are produced by conductive zones, not necessarily sulphides. The direct detection of sulphides with the Turam method requires the sulphides to be present in sufficient amounts and continuity to provide recognisable anomalies. Most of the Turam anomalies in the Dobbyn area are caused by conductive ground water in shears and faults.

The S-P results in the Dobbyn area were not satisfactory, partly because the anomalies were small and tended to be obscured by random variations, and partly because of poor electrode grounding conditions.

The magnetic results in the Dobbyn area showed a large number of anomalies none of which is associated with mineralisation. Basic rocks are the main source of magnetic 'highs'.

Resistance and self-potential logs were made of all the holes except DDH Nos. 1 and 10, which collapsed before logs could be run. The logs indicate the presence of sulphides, generally minor. The sulphides detected in the logs were generally deeper than the depth of current concentrations deduced from Turam results.

Resistivity and IP measurements were made on selected drill core sections in the BMR rock testing laboratory. The method adopted for measurement of the electrical resistivity required application of a small known current to flatly cut ends of core and measurement of the voltage gradient generated near the centre of the core specimen. Normally the cores were soaked in distilled water for at least 24 hours prior to measurement.

The measurement of the IP effect was carried out be immersing the core specimen in water of low conductivity. Small probes in Wenner configuration were placed in the water near the specimen. Small d.c. current (1mA or less) was passed through the outer probes and the decay voltage generated when the current was interrupted was viewed on a storage oscilloscope using a slow time base.

4. DRILLING RESULTS

The main anomalous area found in the 1963 and 1964 geophysical surveys was between 2200E/5200N and 2425E/8000N (Plates 2 and 3). Other anomalies of importance were found in the following localities.

1. The Dobbyn mine area (Plates 2 and 5)
2. The Copperless mine area (Plates 2 and 4)
3. Between 2000E/800N and 1900E/1500N (Plate 2)
4. The Crusader mine (Plate 1)
5. The northern extension of the east lode of the Orphan mine (Plate 2)
6. The area of weak anomalies immediately east of the main anomalous area (Plates 2 and 3).

Twelve diamond-drill holes were recommended to test anomalies. These were three holes (DDH Nos. 1, 2, and 3) to test the main anomalous area, two holes at each of the localities 1 (DDH Nos. 10 and 11), 2 (DDH Nos. 5 and 6), and 3 (DDH Nos. 7 and 8) in the above list, one hole in localities 5 (DDH No. 9) and 6 (DDH No. 4) in the above list, and one hole (DDH No. 12) at 45,000E/0 to test a zone of Turam anomalies.

Eight holes were drilled. These were DDH Nos.1, 2, and 3 in the main anomalous area and DDH Nos. 4, 5, 6, 10, and 11, as described above. Holes 1 and 2 were collared west of the target instead of east as originally recommended. This choice of drill site was made by Australian Selection (Pty) Ltd. Hole 4 was changed from a vertical hole to an angled hole drilling west towards the target. This change was made by the BMR.

Plate 2 shows the positions of the holes as originally recommended. Plates 3, 4, and 5 shows the positions of the holes drilled.

The holes drilled were designed to test IP anomalies, and the drilling targets were deeper than the current concentrations interpreted from the Turam method. However, some information on the sources of the Turam anomalies was expected to be obtained in the cases where the drill hole intersections could be projected upwards towards the surface and within the range of the Turam method.

Summaries of drilling results and resistance logs accompanied by relevant geophysical results are presented in Plates 6 to 11. The electric logs of DDH3 in comparison with sulphur assays are shown in Plate 12. Detailed geological logs and other details (drilling and assays) are given in Appendices 1 to 8. The results of resistivity and induced polarisation tests on core samples are given in Appendix 9.

Diamond-drill holes Nos. 1, 2, and 3

These three holes were in the main anomalous area (Plates 2 and 3).

The geological log of DDH No. 1 shows basic rock (altered dolerite) from 253' 6" to 391' 6" with acid volcanics above and below. A sulphide zone was intersected near the bottom of the basic rock, and extends a few feet into the lower acid volcanics. If the sulphides intersected by DDH No. 1 are continuous with the gossan on the surface, the sulphide zone has a steep easterly dip. Sulphides are the source of the IP anomaly.

The Turam anomaly at 2350E/7000N (Plate 6) is 50 feet west of the gossan as mapped. The hole had collapsed before electric logs could be run, and no correlation between conductivity in the hole and Turam results can be made.

A local magnetic 'low' of about 150 gammas coincides with the Turam anomaly (Plate 6). The magnetic profile shows high magnetic values east and west of the Turam anomaly, suggesting basic rocks where, in part, the drill hole intersected acid volcanics. The frequency effect anomaly is closest to the surface at the Turam anomaly, and this suggests the existence of near-surface sulphides not intersected by the drill hole.

The geological log of DDH No. 2 shows alternating basic rocks and acid volcanics, with sulphide zones in amphibolite between 366 ft and 398 ft.

Sulphides are the source of the IP anomaly and the Turam anomaly at 2350E. The Turam anomaly at 2200E (Plate 7) west of the main mineralisation is probably related to a lateral change in ground conductivity as indicated at 2200E in the apparent resistivity profile. The magnetic 'high' of 2750 gammas has a near-surface source not intersected by the drill hole.

The geological log of DDH No. 3 (Plate 8) shows alternating acid volcanics and basic rocks with sulphide veins from about 237 ft downwards.

The frequency effect anomaly (Plate 8) extends from 24E westward to about 19E and is considerably wider than the frequency effect anomalies at DDH Nos. 1 and 2. No 'lode' was intersected by DDH no. 3, and the IP anomaly is probably due to sulphide veins in porphyry and amphibolite.

The Turam anomaly at 2200E (DDH No. 3) is wider than the Turam anomalies at DDH No. 1 and 2 and, on the evidence of the frequency effect results, coincides with the position where the sulphides are closest to the surface.

A magnetic 'low' coincides with the Turam anomaly.

The electric log of DDH No. 3 (Plate 12) shows self-potential peaks in good agreement with occurrences of sulphide mineralisation. The single-point resistance log indicates low resistance for the highly chloritised amphibolite, high resistance for the section 127 to 238 ft, followed by a low resistance zone to the end of the log (415 ft). Smaller low resistance troughs occur near known mineralisation zones (e. g. 160, 240, and 252 ft).

Resistivity measurements on selected core specimens of DDH No. 3 (Appendix 9) show low resistivity values above 130 ft followed by much higher resistivity values below that depth.

When comparing the geological log of DDH No. 3 with the sulphur assays (Appendix 3 and Plate 12) allowance should be made of the fact that the former was carried out on site immediately after drilling whereas the sulphur assays were performed later after considerable handling of core boxes, during which sections of cores may have slid in core boxes by as much as one foot in either direction.

The sparse sulphide mineralisation recorded in core portion 100 to 159 ft was tested for IP effect and no response was obtained. Weak IP response was obtained in core portions 162 to 164 ft and 169 to 171 ft, which recorded higher sulphide values in assays. Strong IP response was recorded in portion 382 to 384 ft and very strong response was detected in portions 252 to 254 ft and 404 to 406 ft, which averaged sulphur contents of 3.86% and 5.93% respectively. However, portion 176 to 178 ft, which averaged 0.97% sulphur, did not give an IP response whereas several specimens within core portions averaging less than 0.01% sulphur exhibited weak IP response (e.g. 230 to 232 ft). Core portion 280 to 282 ft was not tested for IP response.

From the above investigations it can be concluded that only minor amounts of sulphides are needed to produce a fairly strong IP anomaly, such as that observed on Traverse 5200N. The sulphur assays do not suggest the presence of appreciable disseminated mineralisation.

Diamond-drill hole No. 4

This hole was drilled in the area of weak anomalies immediately east of the main anomalous area (Plates 2 and 3).

The geological log shows amphibolite throughout the hole, with minor occurrences of pyrite from the base of weathering downwards.

Pyritic amphibolite appears to be the source of the IP anomaly. The magnetic profile (Plate 7) indicates amphibolite from about 2650E eastwards. The IP anomaly is east of the boundary of the magnetic 'high', which suggests the amphibolite is not pyritic throughout.

The weak IP anomalies extending north and south of DDH No. 4 (Plate 2) can by analogy be interpreted as due to pyritic amphibolite.

Diamond-drill holes Nos. 5 and 6

These two holes were drilled in the Copperless mine area (Plates 2 and 4).

The geological log of DDH No. 5 shows a basic dyke from 20 ft to 242 ft 6 inches, and then basic rocks and acid volcanics.

The geological log of DDH No. 6 shows the basic dyke from 60 to 310 ft with weak disseminated sulphides. A sulphide zone in calcite and schist occurs immediately west of the dyke and includes a 15-ft intersection assaying 1% Cu.

The magnetic profiles (Plates 9 and 10) show that the dyke is non-magnetic except at its edges. The geological log of DDH No. 6

(Appendix 6) shows magnetite in basic rocks east and west of the dyke; this would explain the disturbed magnetic profiles.

The Turam anomaly on DDH No. 6 (Plate 10) is due to more than one conductor. The frequency effect profile shows that the sulphides are closest to the surface around 2800E, which is within the Turam anomaly, and part of this wide Turam anomaly is due to sulphides.

The frequency effect anomaly at DDH No. 5 (Plate 10) is closest to the surface at about 2850E, which is the position of the Turam anomaly.

The IP anomaly at DDH No. 6 is due to sulphides. Insufficient sulphides were found to account for the IP anomaly at DDH No. 5. The IP results indicate that the sulphides at DDH No. 5 should have at least the same depth extent as at DDH No. 6. Either DDH No. 5 passed through a non-mineralised part of the body, or the sulphide zone dips much more steeply in DDH No. 5 than in DDH No. 6, and the hole did not reach the sulphides. It is also possible that the sulphides stop short of DDH No. 5 and the IP anomaly is caused by sulphides north of the traverse surveyed by IP and detected by a current path north of the traverse.

Diamond-drill holes Nos. 10 and 11

These two holes were drilled 400 ft north of the main Dobbyn shaft, and about 250 ft north of the northern limit of the underground workings (Plates 2 and 5).

The geological logs show alternating acid volcanics and amphibolites. Pyritic lode material, possibly in acid volcanics, was intersected in DDH No. 10 from 296 ft 4 in to 336 ft, immediately below amphibolite.

In DDH No. 11 acid volcanics with minor sulphides were intersected from 495 ft 6 in to the end of the hole (501 ft 3 in), immediately below amphibolite. Either the lode does not extend in depth to DDH No. 11, or it is deeper than DDH No. 11. The rig had already moved from the site when DDH No. 11 was logged, and was drilling DDH No. 5. On completion of DDH No. 5, the drill was moved back to DDH No. 11 to deepen it. However, the casing had been removed and the top part of the hole had collapsed, and it proved impracticable to deepen the hole.

The IP anomaly is due to sulphides. The Turam anomaly is due to sulphides or to conductive water in the shear in which sulphides occur (see geological log, Appendix 7). A local magnetic 'low' of about 500 gammas coincides with the Turam anomaly.

The frequency effect results indicate the depth of the sulphides as at least that of the intersection of DDH No. 11. Disseminated pyrite intersected near the bottom of the hole may be sufficient to account for the frequency effect anomaly at depth.

5. CONCLUSIONS

Eight diamond-drill holes drilled in the Dobbyn area, Queensland, were designed to test IP anomalies.

The three holes in the main anomalous area showed that the IP anomalies there are due to sulphide mineralisation, predominantly pyrite.

The weak anomalies immediately east of the main anomalous area are shown to be due to pyritic amphibolite.

The anomalies in the Copperless mine area are due to sulphide mineralisation, predominantly pyrite. DDH No. 5 did not intersect a source of IP anomalies. The reason was not determined, though a number of explanations are possible.

A sulphide lode, predominantly pyrite, was intersected in a hole 400 ft north of the Dobbyn main shaft. A deeper hole failed to intersect the lode, either because the hole was not deep enough or because the lode does not persist at depth.

Some of the Turam anomalies, e.g. at DDH Nos. 1 and 6, do not appear to be directly related to the sources of the IP anomalies.

In general, the drilling confirmed the interpretation that the IP anomalies are due to mineralisation. The anomalies have been shown to be caused by sulphides, but these are predominantly pyritic and are uneconomic. Only minor amounts of sulphides appear necessary to produce fairly strong IP anomalies. There was no evidence of any useful correlation between the amount of sulphides present and the strength of the IP anomaly.

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APPENDIX 1

DDH NO. 1 DIAMOND-DRILL LOG

Drilled by Glindemann and Kitching for Australian Selection (Pty) Ltd

Collar	2175E/7000N
Bearing	90° (grid)
Depression	-45°
Total Depth	445.1 ft

Geological log by D.J. Chrismas, Australian Selection (Pty) Ltd.

Geological log

Note: Foliation angles measured between foliation plane and core axis.

0'-18'	No core recovered
18'-253' 6"	Porphyritic rhyolite. Pink to grey, fine grained, often sugary texture. Cream potash feldspar phenocrysts. Generally foliated - flow (?) banding, streaking somewhat irregular. Some sections non-porphyritic, these usually greyish in colour. Sharp contact with amphibolite at 253' 6" 140' - foliation at 35° 253' 6"- foliation at 30°
253' 6"-391' 6"	Amphibolite (meta-dolerite). Massive, fine to medium grained, green-black in colour. Composition white feldspar 30%, green-black chlorite and mafics 70%. Often schistose, foliation generally 40°. Some sections relatively unmetamorphosed. Quartz veining becoming common towards 391' 6" with associated sulphides (pyrite and chalcopyrite). 335'-338' Low angled quartz-sulphide vein. Chalcopyrite about 0.5%. 357' Quartz vein with heavy sulphide mainly pyrite; chalcopyrite about 1%. 371'-391' 6" Increasing density of quartz veining and corresponding sulphides. Generally higher chalcopyrite-pyrite ratio.

391' 6"-445' 1" Porphyritic rhyolite, as before. Contact with amphibolite above appears contaminated. Heavier quartz veining and sulphide mineralisation over the first 4 to 5 feet, with a general increase in chalcopyrite content in the sulphides.
410' foliation at 40°.

Assays

From (feet)	To (feet)	Cu (%)	Sulphur (%)
331	335	0.05	
335	338	0.22	
344	347.1	0.10	
347.1	351	0.02	
351	357	Nil	
357	357.4	0.42	21.00
357.4	361.7	0.02	7.13
361.7	363.7	Trace	
363.7	364.4	0.07	
364.4	365.7	Trace	
365.7	366.3	0.17	
366.3	373.5	0.02	
373.5	374.8	0.15	
374.8	376	1.00	
376	377.1	0.05	
377.1	379.2	0.58	
379.2	382.2	0.33	
382.2	386.4	0.82	
386.4	388.8	0.45	
388.8	392.8	0.82	
392.8	394.8	1.75	
394.8	400	0.30	
400	405.7	0.22	

APPENDIX 2

DDH NO. 2 DIAMOND-DRILL LOG

Drilled by Glindemann and Kitching for Australian Selection (Pty) Ltd

Collar	2100 E/6000N
Bearing	90° grid
Depression	45°
Total Depth	470 ft

Geological log by J.S. Auston, Australian Selection (Pty) Ltd.

Geological Log

0-30'	No core
30'-215'	Amphibolite (meta-dolerite); massive; fine to medium grain; 30% white feldspar, 70% green chlorite and black mafics; in places relatively unmetamorphosed, with ophitic texture; scattered chalcopyrite and pyrite.
215'-283'	Porphyritic rhyolite; pink, fine sugary texture, in places cherty; streaky irregular banding; up to 20% pink and white euhedral phenocrysts of potash feldspar and some quartz "eyes".
283'-320' 6"	Rhyolite, as before but non-porphyritic and more grey in colour; possibly tending more to dacite in composition; sharp contact with amphibolite at 320½ ft.
320' 6"-406'	Amphibolite (meta-dolerite) as before; much medium to coarse grain; some pink feldspar; contains sulphide mineralisation associated with shearing and quartz veining at footwall contact.
	366'-396' 6". Irregular quartz veining and chlorite alteration; schistose; average 10% pyrite, pyrrhotite and chalcopyrite associated with quartz.
	374'-375' 6". Quartz veining; average 5 to 8% pyrite, pyrrhotite and chalcopyrite.

375' 6"-382' 6".	Average about 20% sulphides; heaviest sections 377'-379' and 381'-382'. 35 to 40% sulphides dominantly pyrite and pyrrhotite in irregular streaky patches associated with quartz; heavier sections sufficiently continuous to be conductive.
394'-398'	Quartz vein containing large blobs of chalcopyrite and pyrite and one section (395'-396') of 70% sulphides (chalcopyrite plus pyrrhotite and pyrite) sufficiently continuous to be conductive.

406'-470' Carbonatized shear zone; grey white, strongly foliated soft carbonate rock; in places shows remnant feldspar phenocrysts as in the preceding rhyolite; becoming harder and less altered toward 470'.

Assays

from (feet)	to (feet)	Cu (%)	Au
366.5	369.0	0.36	Trace
373.8	376.3	0.34	Trace
376.3	379.3	1.11	Trace
379.3	382.3	0.29	Trace
394.3	397.6	5.88	Trace

APPENDIX 3

DDH NO. 3 DIAMOND-DRILL LOG

Drilled by Atlantic Drillers for BMR

Collar	2350E/5200N
Bearing	270° (grid)
Depression	-50°
Total Depth	450 ft 4 in

Geological log by D.J. Chrismas, Australian Selection (Pty) Ltd

Geological Log

0-48'	No core recovered
48'-127'	Amphibolite. Sometimes rather schistose. Some sections highly chloritised. Quartz and calcite veining fairly common. There are occasional sulphides from about 100 ft downwards consisting mainly of chalcopyrite with some chalcocite and pyrite. 103'6"-105'2" Chalcopyrite and chalcocite, each ½% to 1% with quartz veining; also chalcopyrite as disseminated crystals.
127'-137'2"	Porphyry. Rhyolite porphyry with minor chalcopyrite.
137'2"-139'5"	Basic schist. 137'6" - four-inch quartz vein with about 1% chalcopyrite.
139'5"-159'	Porphyry. Rhyolite porphyry with minor chalcopyrite.
159'-262'7"	Amphibolite and basic schist. 159'-162' Schist 162'-238' Amphibolite 238'-240'9" Schist 240'9"-262'7" Amphibolite. 240'0"-241'11" rather brecciated, quartz rich; chalcopyrite about 2%, pyrite about 1%. 252'3"-254'0" as above, less chalcopyrite. 258'7", several wide crystalline calcite veins containing pyrite and minor chalcopyrite. 259'9", as above.
262'7"-285'6"	Porphyry. Appears rather silicified (?) and partly foliated.

	264'8"-265'	Pyrite and chalcopyrite, each about 1%, in bands parallel to the foliation.
	285'6"	Sulphide band, ½ inch wide with about 1% chalcopyrite.
285'6"-312'10"	Basic rock. Mainly amphibolite with some schist. Extensive calcite and quartz veining. Minor sulphides.	
312'10"-410'7"	Porphyry. As for 262'7"-285'6" generally; very minor disseminated sulphides.	
	336'2".	A 2" wide calcite band with pyrite and chalcopyrite about equal, 15% to 20%.
	342'	Minor sulphides as banding or veining, chalcopyrite and pyrite.
	352'9"	A 5" calcite vein with sulphides, mainly chalcopyrite (2%) with pyrite (1 to 2%).
	362'3"	Minor sulphide banding
	379'7" and 380'10"	Half-inch wide sulphide bands with calcite veinings. The top sulphides (about 15%) with chalcopyrite about 9%. The lower vein about 70% sulphides, pyrite about 45%, chalcopyrite about 25%.
	384'4"	Quarter-inch wide sulphides with quartz and calcite. Mainly chalcopyrite with pyrite.
	398'6"	One-inch wide sulphide banding with pyrite greater than chalcopyrite.
	403'3"-404'	Pyrite and chalcopyrite with quartz; pyrite greater than chalcopyrite.
410'7"-416'9"	Brecciated contact zone. Contact of porphyry and amphibolite. A few quartz veins with sulphides, mainly pyrite.	
416'9"-450'4"	Amphibolite. Quartz and calcite veining with some sulphides. Minor disseminated chalcopyrite and pyrite.	

Assays

From (feet)	To (feet)	Sulphur (%)
130	132	<0.01
132	134	0.02
134	136	0.05
136	138	<0.01
138	140	0.02
140	142	0.02
142	144	<0.01
144	146	<0.01
146	148	<0.01
148	150	<0.01
150	152	<0.01
152	154	<0.01
154	156	0.05
156	158	0.39
158	160	0.11
160	162	0.40
162	164	2.00
164	166	0.12
166	168	0.15
168	170	0.24
170	172	0.34
172	174	0.30
174	176	0.44
176	178	0.97
178	180	0.16
180	182	0.11
182	184	0.06
184	186	0.08
186	188	<0.01
188	190	0.02
190	192	0.09
192	194	<0.01
194	196	0.07
196	198	0.01
198	200	0.04
200	202	0.32
202	204	0.11
204	206	0.10
206	208	<0.01
208	210	0.15
210	212	0.07
212	214	0.06
214	216	0.07
216	218	0.13
218	220	0.03
220	222	<0.01
222	224	0.04

From (feet)	To (feet)	Sulphur (%)
224	226	0.01
226	228	<0.01
228	230	0.03
230	232	<0.01
232	234	<0.01
234	236	<0.01
236	238	<0.01
238	240	0.23
240	242	0.55
242	244	<0.01
244	246	0.34
246	248	0.32
248	250	<0.01
250	252	<0.01
252	254	3.86
254	256	<0.01
256	258	1.12
258	260	0.08
260	262	<0.01
262	264	0.16
264	266	<0.01
266	268	<0.01
268	270	0.02
270	272	0.04
272	274	0.18
274	276	<0.01
276	278	<0.01
278	280	<0.01
280	282	3.49
282	284	<0.01
284	286	0.05
286	288	<0.01
288	290	0.06
290	292	0.06
292	294	0.10
294	296	<0.01
296	298	0.40
298	300	0.49
300	302	0.01
302	304	<0.01
304	306	0.21
306	308	0.08
308	310	0.14
310	312	0.15
312	314	0.10
314	316	<0.01
316	318	<0.01
318	320	<0.01
320	322	<0.01

From (feet)	To (feet)	Sulphur (%)
322	324	<0.01
324	326	<0.01
326	328	<0.01
328	330	<0.01
330	332	<0.01
332	334	<0.01
334	336	<0.01
336	338	0.25
338	340	<0.01
340	342	<0.01
342	344	<0.01
344	346	<0.01
346	348	<0.01
348	350	<0.01
350	352	<0.01
352	354	0.18
354	356	<0.01
356	358	<0.01
358	360	<0.01
360	362	<0.01
362	364	0.11
364	366	<0.01
366	368	<0.01
368	370	<0.01
370	372	<0.01
372	374	<0.01
374	376	<0.01
376	378	<0.01
378	380	<0.01
380	382	0.16
382	384	0.59
384	386	0.09
386	388	<0.01
388	390	<0.01
390	392	<0.01
392	394	<0.01
394	396	<0.01
396	398	0.86
398	400	2.23
400	402	<0.01
402	404	<0.01
404	406	5.93
406	408	<0.01
408	410	<0.01
410	412	<0.01
412	414	2.73
414	416	0.10
416	418	<0.01
418	420	<0.01

From (feet)	To (feet)	Sulphur (%)
420	422	<0.01
422	424	0.29
424	426	0.08
426	428	0.33
428	430	0.33
430	432	0.16
432	434	0.14
434	436	0.15
436	438	<0.01
438	440	<0.01
440	442	<0.01
442	444	0.22
444	446	2.35
446	448	0.12
448	450	<0.01

APPENDIX 4

DDH NO. 4 DIAMOND-DRILL LOG

Drilled by Atlantic Drillers for BMR

Collar	3350E/6000N
Bearing	270° (grid)
Depression	-55°
Total Depth	403 ft

Geological log by W. B. Dallwitz

Geological log

Water 71', cased to about 148'

0-30'	No recovery. Rubble (quartz and quartzite). Very difficult to penetrate.
30'-63'	Very weathered, strongly sheared amphibolite and biotite schist. Core very much broken.
63'-105'	Weathered amphibolite, strongly sheared; core badly broken and rubbly in places. Shearing appears to be close to vertical or dips steeply W. Shear-planes crenulated at 76'. Pockets and veinlets of quartz at about 75'6", 97'- 97' 6" 100'-101' (impregnated with quartz). Fresh rock at 105'.
105'-132'6"	Strongly sheared amphibolite, heavily impregnated with pale grey, largely non-effervescing carbonate ((?) dolomite) and/or scapolite. Dip of cleavage vertical or steeply E. Abundant blebs of white mineral in sub-hedral to euhedral grains, measuring about 1 mm, from 105'-105'6". Streaks and splashes of sulphide, including some chalcopyrite, but mainly pyrite, 105'6", 108'5"-110'5" (accompanied by chlorite in places). ¼" pyrite at 125'.
132'6"-135'9"	Amphibolite, less strongly sheared than in previous section, and impregnated with (?) non-effervescing carbonate. Some calcite along joints. 1/16" veinlet along joint at 133'.
135'9"-136'9"	Quartz vein with patches of pyrite and traces of chalcopyrite irregularly distributed.
136'9"-151'	Amphibolite, as for 132'6"-135'9". At 146'2" small pockets of pyrite with associated non-effervescing carbonate, calcite, quartz and chlorite.

151'-183'6"	Amphibolite, more massive (?) dolomitized. Streaks of pyrite and scattered pyrite 155'-155'6", 160'-160'6", 168'6"-169'6", 173'6"-174', 177'3", 180', 183'6".
183'6"-200'	Hard, fine-grained, grey siliceous rock interspersed with about 30% sheared, carbonated, and non-carbonated amphibolite. Traces of pyrite, with or without chalcopyrite, 189'6"-[illegible], 193'6", 196'.
200'-222'	Strongly sheared amphibolite, carbonated in some places over widths of 1/16"-$\frac{3}{4}$". Carbonate about 5-7%. Traces of chalcopyrite 202', 203'3", 206'6".
222'-230'6"	Strongly sheared amphibolite, mostly strongly (?) dolomitised.
230'6"-236'6"	Strongly sheared amphibolite, little carbonated, probably chloritized; some carbonate effervesces, some does not. Veinlet consisting of chlorite, carbonate, and a little pyrite at 236'6".
236'6"-253'6"	Strongly sheared amphibolite, probably fairly heavily carbonated. Some calcite in places, especially in $\frac{1}{2}$"veins about 244'9". Very sparsely scattered pyrite throughout. Some stringers of pyrite (some of which are associated with veinlets of calcite) at 238'-238'3", 240'3"-240'6", 245'6"-245'9".
253'6"-276'6"	Amphibolite, possibly dolomitized, chloritized in a few places. Very sparsely scattered pyrite and chalcopyrite, some concentrated as narrow veinlets at 258' and 258'3". Pockets of calcite at 265', 260'6" (here subordinate to dolomite). Quartz at 260'3"; $\frac{1}{2}$" calcite vein at 265'8"; 2" calcite 266'7"-266'9". Few grains of pyrite in veinlet at 269'4"; $\frac{1}{4}$" calcite at 276'3". Calcite, dolomite and quartz 270'8"-271'. Chalcopyrite - (?) pyrrhotite stringers at 270'6" and 271'.
276'6"-296'	Amphibolite of variable appearance, generally with less (?) dolomite than in previous section. Quartz and/or carbonate at intervals, generally with associated chlorite. Pyrite and a little chalcopyrite at 280'3". Chalcopyrite in quartz and carbonate at 280'6". $\frac{1}{8}$" pyrite with trace of chalcopyrite at 282'. 1/16" pyrite with trace of chalcopyrite at 284'6". At 284'9", 1" massive pyrite with about 10% coarse chalcopyrite. 285'-285'3", several thin, discontinuous stringers of pyrite and chalcopyrite.

At 290'9" pyrite (in crystals up to ½" across) along joint, with quartz, calcite, and probable dolomite. At 291'9", 1" quartz containing a few coarse grains of pyrite and chalcopyrite. At 293'9" some pyrite along cleavage and joint.

296'-338' Strongly sheared amphibolite and schistose "amphibolite" (biotite schist) containing abundant streaks of (?) dolomite in places, and flecks of an unknown white mineral over intervals up to 1". Pyrite and chalcopyrite along cleavage at 295', 301'2", 311', 315'9", 1½" of pyrite and very rare chalcopyrite associated with chlorite, calcite, (?) dolomite, and quartz at 324'6".
Narrow, discontinuous stringers of pyrite at 325'3", 325'6", 331'6", 334'-335'6".

338'-355 Rather massive amphibolite, pervaded by pink feldspar 343'9"-345', strongly concentrated over 1½" at 344'3", where it is accompanied by epidote and a little pyrite. 1/16" vein of pink feldspar at 345'9".

355'-403' (end of hole). More strongly sheared amphibolite containing some biotite. Narrow (up to ¼") streaks and pockets of calcite at frequent intervals. 1" calcite at 301'9".
A little pyrite and chalcopyrite at 368' and 368'9".
Dip of cleavage at 392' = 50°E, at 399' = 60°E, at 403' = 80°E to vertical.

APPENDIX 5

DDH NO. 5 DIAMOND-DRILL LOG

Drilled by Atlantic Drillers for BMR

Collar	3050E/17500N
Bearing	270° (grid)
Depression	-45°
Total Depth	413 ft

Geological log by W. B. Dallwitz

Geological log

0-10'	No core.
10'-20'	Very broken core, probably amphibolite. 13'3"-14'6" veins of unknown bright reddish pink mineral, with associated epidote, at intervals. Some magnesite 10'-12'.
20'-22'9"	Core fairly solid, probably part of chilled margin of later dolerite dyke. Some core, probably of strongly chilled basic rock, appears to be out of sequence near 22'9".
22'9"-28'6"	Core mostly solid. Fine-grained dolerite dyke-rock.
28'6"-35'6"	Core mostly very broken, probably fine-grained dolerite.
35'6"-38'	As for last section, but core solid.
38'-54'	Notably coarser dolerite with pink alteration of feldspar in places.
54'-87'	Coarse dolerite, roughly banded about 70'-71'6". A little pink alteration of feldspar in places.
87'-146'	Coarse dolerite. Pink alteration of feldspar variable, but common in places.
146'-227'	Grey dolerite, coarse, somewhat variable in colour, possibly depending on whether or not pyroxene is altered. Unusually dark 169'9"-170'6". A little pink alteration of feldspar in places. Gradually becoming less coarse after about 207'
227'-237'	Notably finer-grained dolerite.
237'-242'6"	Still finer-grained dolerite, becoming progressively finer-grained towards chilled margin at about 242'6".

242'6"-274'3"	Strongly sheared amphibolite and biotite schist. Lenses and patches of pink chert or fragments of acid volcanic at wide intervals in first 10' of this section. Lenses of white (?)scapolite in places. Streak of chalcopyrite at 259'6". 2" quartz with a few percent chalcopyrite 260'-260'2".
274'3"-280'6"	Grey porphyritic acid volcanic rock, sheared.
280'6"-281'9"	White to pinkish quartz with patches of epidote. A few specks of chalcopyrite in last $\frac{1}{2}$".
281'9"-283'7"	Pink silicified acid volcanic rock.
283'7"-327'	Grey sheared acid volcanic rock with white porphyritic crystals (feldspar) in places. Quartz veins, $\frac{1}{8}$" to $\frac{1}{2}$" wide, at intervals. $\frac{1}{8}$" to $\frac{1}{2}$" siliceous vein with pyrite and chalcopyrite at 297', and silicified rock with conspicuous pyrite and chalcopyrite over next 3". 297'8"-297'9$\frac{1}{2}$", quartz with coarse pyrite and a little chalcopyrite.
327'-327'9"	Probably amphibolite with about 1" of 30% pyrite mineralization in the middle.
327'9"-330'	Grey acid volcanic rock, porphyritic (feldspar) in places.
330'-331'9"	Largely quartz; some altered rock. A zone about $\frac{3}{4}$" wide at 331'3" contains about 10% chalcopyrite.
331'9"-413'	Strongly sheared "amphibolite", probably mainly converted to biotite schist. White streaks throughout, some consisting of calcite. Irregular veins of grey calcite, up to 1" thick from 336'2" to 336'8". At 345' about 1" quartz with a few percent pyrite. Core slightly weathered and broken at intervals, especially 332'-334'6", 341' ± 2", 346' ± 6", 374'6"-376'6". Fresh rock with very few white streaks after 376'6".

APPENDIX 6

DDH NO. 6 DIAMOND-DRILL LOG

Drilled by Ausminda Pty Ltd

Collar	3050E/18500N
Bearing	270° (grid)
Depression	-45°
Total Depth	519 ft

Geological log by R.H. Gessner, Ausminda Pty Ltd

Tropari survey

100 ft	N87°W, -45°
300 ft	N85°W, -45°
500 ft	N85°W, -35°

Geological log

0-28'	No core.
28'-45'	Decomposed biotite schist? (No core, all sludge). Pyritic.
45'-59'4"	Biotite feldspar schist, well foliated with thin quartz veinlets abundant; pyrite, disseminated and on calcite coated fractures. Local strong magnetite. Foliation 50° at 55 ft.
59'4"-309'8"	Basaltic dyke. 59.3' Basaltic dyke, fine chilled margin. 60'-120' Baslatic dyke as above with disseminated pyrite; increase in grain size to dolerite or gabbroic type. Massive, no lineation. 120-180' Same dyke as preceding. Coarse grained, very few fractures. ~130' gradational increase in orthoclose (secondary?). 150' fracture, trace chalcopyrite. 169' and 178' fractures. 180-240'. Dyke as preceding; weak disseminated pyrite in coarse grain massive basic dyke; mafics, plagioclase, and (secondary?) orthoclase; occasional disseminated chalcopyrite. 240-300'. Dyke as preceding; weak disseminated pyrite and trace of chalcopyrite. ~270' gradational loss of orthoclase. ~298' grain size gradationally decreases. 300-309.7' Fine grain chilled border zone of basic dyke as preceding. 306' calcite.
309'8"	± 30" igneous contact; end of dyke.

309'8"-351' Biotite-feldspar schist, meta-basic volcanic (?), weak brecciation near contact; weak disseminated pyrite and strong magnetite mixed with biotite. Banded siliceous zones parallel to foliation.

- 322'-323'. Strong pyrite.
- 330-335'. Very weak pyrite, strong magnetite.
- 335-340'. Trace pyrite, very strong magnetite.
- 340-345'. Strong pyrite and weak chalcopyrite; strong magnetite. Mineralisation mostly parallel to foliation.
- 345-351'. Traces of pyrite; local strong chalcopyrite at 348' and 350' associated with quartz.

351'-354' Aphantic light coloured silica rock; local bands chalcopyrite.

354'-363' Mostly white crystalline calcite with local strong chalcopyrite, pyrite and pyrrhotite; some silica associated with sulphide zones.

363'-368' Silicified meta-volcanics.

368'-372' Biotite-feldspar meta-basic volcanics as preceding; silica zones 372'.

372'-381'6" Mostly white crystalline calcite as above; disseminated chalcopyrite.

381'6"-420' Biotite-feldspar schist, meta-basic volcanics as above; chalcopyrite mostly in calcite; traces of pyrite, chalcopyrite in schist. Local chalcopyrite at 391' traces below.

420'-519' Biotite schist as preceding with calcite and thin quartz zones.

- 423-435' locally stronger chalcopyrite and bornite.
- 480-485' local strong pyrite, traces of pyrite.
- 485-490' traces of pyrite
- 507'6" Calcite zone, pyrite and chalcopyrite on border.
- 510'-515' Very fine grain rock practically all biotite.

Assays

From (feet)	To (feet)	Cu (%)
340	345	0.22
345	350	Trace
350	355	0.13
355	360	0.57
360	365	1.32
365	370	1.81
370	375	1.10
375	380	0.44
380	385	0.26
385	390	Trace

APPENDIX 7

DDH NO. 10 DIAMOND-DRILL LOG

Drilled by Atlantic Drillers for BMR

Collar	1150E/400N
Bearing	270° grid
Depression	-55°
Total Depth	501 ft 3 inches

Geological log by W. B. Dallwitz

Geological log

0-10'	No core. Broken core to 11'6"; then more or less unbroken core.
10'-48'6"	Pinkish brown to pink porphyritic acid volcanic rock; some feldspar crystals preserved 42'-43'.
48'6"-66'6"	Yellowish grey sheared sericitized acid volcanic rock.
66'6"-81'6"	Pinkish brown porphyritic acid volcanic rock.
81'6"-98'4"	Sericitized and sheared acid volcanic rock, pink in places, probably through alteration. Porphyritic crystals, especially of quartz, visible in most places.
98'4"-166'	Pinkish brown and pinkish grey porphyritic acid volcanic rock, gradational from previous section for first 2'6". Epidote stringers. (About 9' of core appears to be missing between 141'6" and 162'4", but no break in rock type was noticed).
166'-178'	Light grey sheared and silicified acid volcanic rock.
178'-196'	Light grey and pinkish grey porphyritic acid volcanic rock, somewhat sheared and altered in places.
196'-211'6"	Amphibolite, dark, fine-grained, and rather massive. Strongly replaced by pale pink (?) carbonate, with quartz and a little calcite, 204'5"-205'10".
211'6"-240'3"	Amphibolite, lighter coloured, and more obviously feldspathic than last section. Very strongly veined with quartz (and/or albite) from 212'9" to 215'; some pyrite and chalcopyrite in first ½", and cavernous from 212' to 212'9". 1" quartz

	at 203'4". 232'1"-234', strongly impregnated with quartz; some calcite and a trace of sulphides. 238'6"-238'9", quartz and calcite with 1-2% chalcopyrite.
240'3"-259'3"	Darker amphibolite - less obvious feldspar; possibly finer-grained than last section. 254'6"-254'9", quartz and carbonate. 258'3"-258'6", broken quartz.
259'3"-296'4"	Lighter coloured amphibolite, probably with a good deal of biotite. Broken to solid quartz 264'6"-265'2". 277'9"-279' very strongly impregnated with quartz. 283'3"-283'9", quartz cavernous in places, with a little irregularly distributed pyrite and chalcopyrite.
296'4"-336'	Very altered and brecciated lode material with abundant quartz; looks like grey, porphyritic acid volcanic rock in places. 1" containing 70% pyrite at 296'8". Pyrite 296'4"-296'8". Probable acid volcanic, grey and porphyritic, 297'6"-299'. 2" containing 30-40% pyrite at 301'4" ± 1". Largely quartz 323'6"-336', with pyrite 330'9"-331'3". 331'9"-336' rich in pyrite in many places, but low in pyrite 333'-334'. The pyrite lode from 330'9"-336' is partly weathered.
336'-353'6"	Sheared and silicified biotite-bearing (?)acid volcanic rock with a little mineralisation in places, e.g. 344'1"-344'5" (quartz, pyrite, and chalcopyrite).
353'6"-400'	Acid volcanic rock, sheared in places.

APPENDIX 8

DDH NO. 11 DIAMOND-DRILL LOG

Drilled by Atlantic Drillers for BMR

Collar	1150E/400N
Bearing	270° (grid)
Depression	-75°
Total depth	501 ft 3 inches

Geological log by W. B. Dallwitz

Geological log

0-8'	No core- only surface rubble.
8'-16'	Broken rock - acid volcanic
16'-55'	Medium pinkish brown slightly sheared to almost massive acid volcanic rock with porphyritic quartz and feldspar; some parts are slightly pinker than others.
55'-57'	Light grey porphyritic acid volcanic rock with a pink tinge. Epidote and quartz in the last 2".
57'-71'6"	Pinkish brown and pink porphyritic acid volcanic rock, slightly sheared. Porphyritic minerals are quartz and feldspar. Irregular patch of metasomatic biotite at 62'; calcite along joint at 62'.
71'6"-99'	Pale yellowish grey sericitized and moderately sheared acid volcanic rock; feldspar crystals almost entirely destroyed. Rock pink through alteration, 92'3"-93' and 97'9"-98'6".
99'-129'	Medium grey and pink, red, and pinkish grey porphyritic acid volcanic rock, slightly sheared. Biotite and epidote at 104'; streaks of biotite 126'6"-127'3".
129-234'6"	Pink, brownish pink, and greyish pink acid volcanic rock, slightly sheared to almost massive. 1½" quartz at 141' with biotite and/or chlorite developed 1" to 4" out from the vein. Quartz 148'6"-149'3". Streaks of epidote 139'2", 139'6". Some chalcopyrite, quartz, calcite, epidote, and (?)biotite at 187'3". Several ⅛" veins of quartz with a little biotite 194'6"-195'6"; rock light pink in this section. ½"-¾" quartz, with a little biotite, at 225'. Trace of chalcopyrite at 228'.

234'6"-268'3"	Rock similar to above, but generally pinker. ¼" quartz and epidote at 265'6". ¼" quartz, epidote, and biotite at 265'9". Streaks of biotite 259' ± 2". ⅓" quartz, epidote, and red(?)albite at 268'.
268'3"-322'	Strongly porphyritic pinkish grey to pinkish brown acid volcanic rock with abundant white to slightly pink feldspar phenocrysts. Rock slightly sheared to massive. (?)Biotite lenticles with subparallel orientation, conspicuous in places.
322'-370'2"	Rather strongly sheared, but not cleaved, acid volcanic rock, probably the same as in last section (268'3"-322') originally. Few signs of porphyritic crystals in sheared parts. Much less sheared with abundant porphyritic crystals (generally finer than in section 268'3"-322') at the following intervals: 346'4"-348'3", 358'3"-359'6", 360'3"-361'6", 364'-369'9" (parts of this section very dark, possibly due to biotite). Abundant biotite streaks 322'-322'6". Rock heavily impregnated with quartz 332'-333'; 337'6"-339'2" (few specks of pyrite at 339'2"); 353' ± 3"; 362'6" ± 3". About 1" quartz and calcite with 1-2% chalcopyrite at 366'9". 3" quartz vein at 367'9", with 2" biotite-rich rock on either side; ⅓"-¾" of quartz with up to 25% pyrite, with trace of chalcopyrite at 367'9". Some sulphide also at 368'2".
370'2"-400'	Medium-grained slightly sheared amphibolite with biotite in places, and with very scattered pyrite. Small veins and pockets of quartz with a little pyrite and chalcopyrite, 370'4"-370'8". Scattered pyrite 371'-373'. ⅓" quartz with a little pyrite and a trace of chalcopyrite at 373'9". At 383', 1" of rock impregnated with quartz, several percent pyrite, and a little calcite. 396'-397' impregnated with quartz; about 10% pyrite. 397'5"-398'4" irregularly impregnated with quartz; 1-2% sulphide (pyrite and chalcopyrite), some calcite. (396'-398'4", some scattered sulphide between recorded sections, and also for a few inches after 398'4").
400'-415'	Amphibolite, similar to that in previous section, but more biotite-rich generally, and more strongly sheared, especially between 405' and 410'. Rock impregnated with stringers of quartz containing less than 1% of sulphide-nearly all chalcopyrite, some pyrite.

415'-473'	Amphibolite, richer in biotite in some places than in others. Generally rather poorly cleaved. 416'9"-419'9", irregular concentrations of red mineral ((?)albite). 417'1", ½" to 1" quartz vein. 422', ⅛" stringer of quartz with a trace of chalcopyrite and pyrite. 429'-429'9", a few stringers of quartz containing about 5% chalcopyrite and pyrite. 430'-430'4", impregnated with quartz, and containing 25-30% pyrite. 440'9", ½" to 1" quartz with a few percent pyrite and chalcopyrite, and some calcite. 444'4"-445'5", some quartz-chlorite veins up to 2" wide. 447'3"-447'9", quartz with a little chlorite. 453'-453'6", quartz, chlorite, calcite, some coarse pyrite, trace of chalcopyrite. 458'-459', impregnated with quartz; conspicuous red (?)albite. 462'6", some chalcopyrite along cleavage over ⅛" width. 463'9"-464', few stringers of quartz containing a little pyrite and chalcopyrite. 468'-468'6", pockets and veins of quartz, chlorite, and minor pink feldspar. 468'9"-469', ½" and 1" veins of quartz with a few splashes of chalcopyrite.
473'-495'6"	"Amphibolite", very rich in biotite in places, and generally strongly cleaved. Core broken 478'-481'6", very rich in biotite. 474'6", ½" quartz with a little pyrite and chalcopyrite. 481'6"-482'10", pockets and veinlets of quartz, up to ½" wide, containing a little pyrite and subordinate chalcopyrite; rock between veinlets also contains scattered pyrite. 484'6", 1" quartz with calcite and several percent chalcopyrite and pyrite. 485'4"-487'4", impregnated with quartz and subordinate calcite veins containing about 1% pyrite and chalcopyrite; some sulphide in amphibolite also. 489'-491'9", quartz with pyrite and chalcopyrite, together totalling about 10%; some calcite (this interval is easily the best in this hole). 494'1"-494'6", quartz impregnated; a little chalcopyrite concentrated in ½" vein at 494'6".
495'6"-501'3"	Sheared, porphyritic acid volcanic rock with some small grains of pyrite and chalcopyrite. Rock contains abundant biotite in first 15" to 18" of this interval.

<u>Assays</u>

Possibly section 489'-491'9" should be assayed. But assuming equal quantities of pyrite and chalcopyrite, copper would come to about 2% or less, and this does not seem to be significant over 2'9" width.

APPENDIX 9

RESISTIVITY AND INDUCED POLARISATION TESTS ON CORE SAMPLES

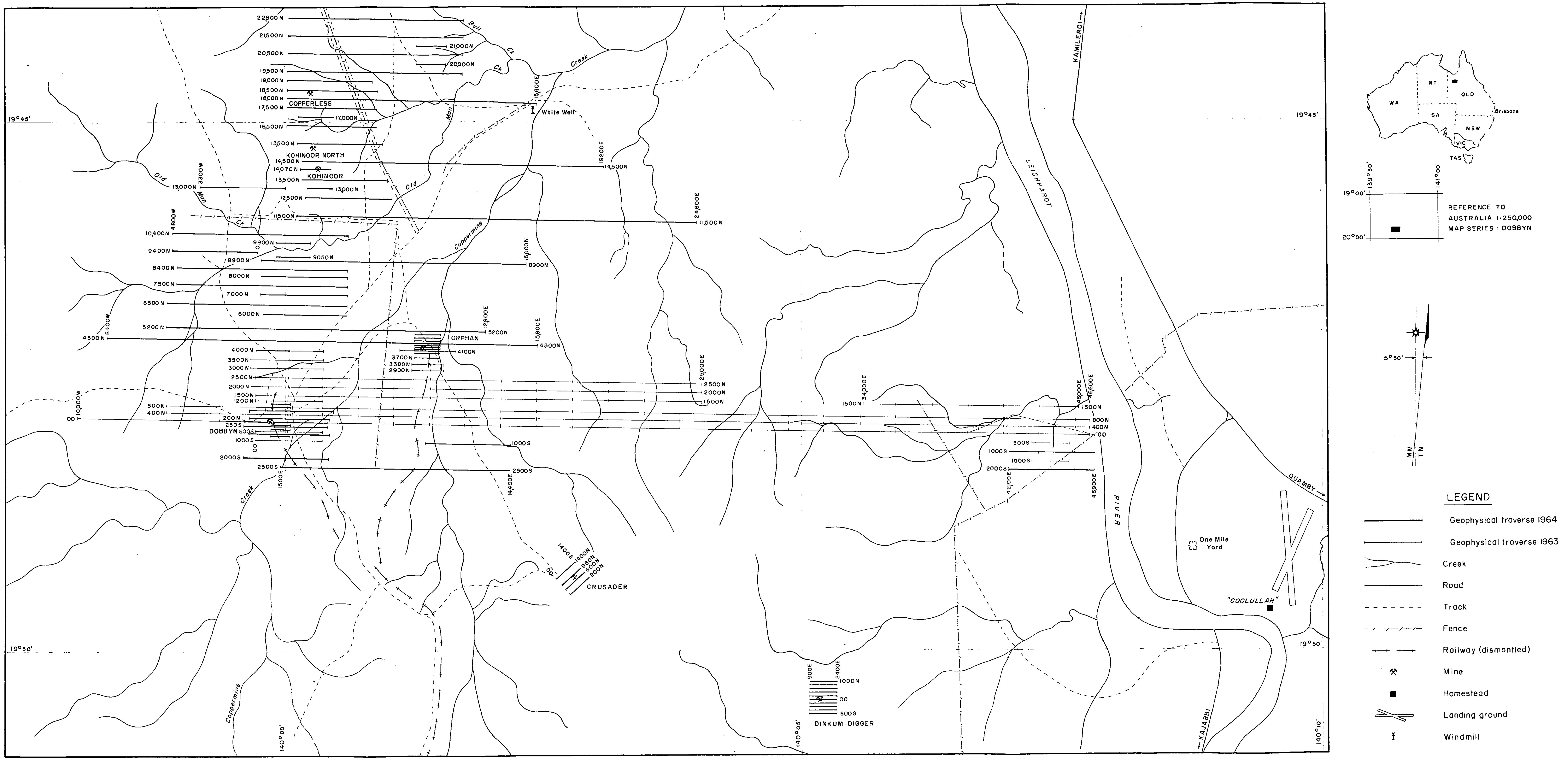
Drill hole No.	Depth Ft	In		Ft	In	Resistivity in ohm-metres	IP Response
DDH 3	76	2	-	76	9	382	Nil
	90	11	-	91	5	41	Nil
	90	3	-	90	11	128	Nil
	93	0	-	93	9	198	Nil
	100	7	-	101	0	38	Nil
	104	0	-	104	9	440	Nil
	110	10	-	111	4	166	Nil
	116	4	-	116	9	329	Nil
	119	6	-	120	2	-	Nil
	129	1	-	129	7	315	Nil
	130	2	-	130	9	2160	Nil
	124	7	-	124	11	1720	Nil
	133	0	-	133	7	9240	Nil
	145	10	-	146	5	25300	Nil
	156	0	-	156	7	8950	Nil
	160	11	-	161	3	1240	Nil
	162	3	-	162	8	4470	Weak
	169	7	-	170	5	1620	Weak
	176	10	-	177	4	3870	Nil
	183	2	-	183	9	7000	Nil
	188	8	-	189	4	4540	Nil
	206	6	-	207	-	5120	Nil
	209	2	-	209	9	11550	Nil
	231	10	-	232	6	9600	Weak
	239	2	-	239	7	4550	Nil
	241	0	-	241	9	-	Nil
	244	4	-	244	11	10000	Nil
	251	7	-	253	2	9880	Very Strong
	266	11	-	267	5	55800	Nil
	279	4	-	279	11	37800	Nil
	285	2	-	285	9	6910	Weak
	293	0	-	293	4	13480	Nil
	300	5	-	300	9	601	Nil
	305	5	-	305	9	16600	Nil
	318	2	-	318	8	8200	Nil
	337	0	-	337	6	11400	Nil
	382	9	-	383	3	12200	Strong
	400	4	-	400	10	14150	Weak
	404	0	-	404	8	12200	Very Strong
	410	6	-	411	0	11690	Weak
	430	2	-	430	8	12050	Nil
	439	8	-	440	2	17830	Nil

Drill hole No.	Depth Ft	In		Ft	In	Resistivity in ohm-metres	IP Response
DDH 10	23	6	-	24	1	2100	Nil
	38	8	-	39	2	1910	Nil
	45	4	-	45	9	147	Nil
	64	2	-	64	7	375	Nil
	77	11	-	78	4	1470	Nil
	96	8	-	97	1	570	Nil
	111	6	-	112	0	3610	Nil
	140	0	-	140	4	-	Nil
	175	6	-	176	0	2042	Nil
	-	-	-	-	-	692	Nil
	208	11	-	209	6	1980	Nil
	212	10	-	213	3	210	Very Strong
	232	8	-	233	1	664	Nil
	249	10	-	250	4	404	Weak
	260	10	-	261	4	1140	Nil
	271	6	-	271	11	1205	Nil
	280	6	-	281	0	74	Nil
	280	3	-	280	6	158	Nil
	281	0	-	281	11	-	Nil
	282	10	-	283	2	67	Nil
	283	5	-	283	11	72	Nil
	284	4	-	284	9	72	Nil
	292	5	-	292	9	-	Nil
	297	0	-	298	8	-	Nil
	304	7	-	305	0	492	Nil
	306	2	-	306	8	-	Nil
	308	0	-	308	3	43	Nil
	313	3	-	313	9	-	Nil
	324	0	-	324	4	858	Nil
	332	9	-	333	3	111	Very Strong
	338	7	-	339	1	107	Nil
	341	4	-	341	10	32	Nil
	349	2	-	349	8	3103	Nil
	354	0	-	354	6	6496	Nil
	355	7	-	356	1	2440	Nil
	374	3	-	374	9	3080	Nil
	390	10	-	391	2	-	Nil
DDH 5	49	2	-	49	7	5550	Nil
	80	0	-	80	6	3810	Nil
	92	10	-	93	4	2470	Nil
	104	7	-	105	0	2090	Nil
	127	7	-	128	1	2580	Nil
	146	7	-	147	0	4470	Nil
	169	4	-	169	8	1180	Nil
	195	7	-	196	1	2000	Nil
	219	1	-	219	6	945	Nil
	241	10	-	242	4	9670	Nil
	245	0	-	245	6	2930	Nil
	247	0	-	247	6	1440	Nil

Drill hole No.	Depth Ft	In		Ft	In	Resistivity in ohm-metres	IP Response
DDH 5	253	0	-	253	6	5010	Nil
	254	9	-	255	3	3680	Nil
	256	8	-	257	2	6350	Nil
	259	6	-	259	10	-	Strong
	265	0	-	265	5	10800	Nil
	274	6	-	275	0	5550	Nil
	297	2	-	297	8	9310	Nil
	313	2	-	313	7	1770	Nil
	330	10	-	331	4	4760	Nil
	336	4	-	336	10	6530	Weak
	347	0	-	347	6	2220	Nil
	365	4	-	365	10	6490	Nil
	385	4	-	385	9	10900	Nil
	403	9	-	404	2	3175	Nil

Note

No resistivity measurements could be made on specimens that broke while being prepared for testing.

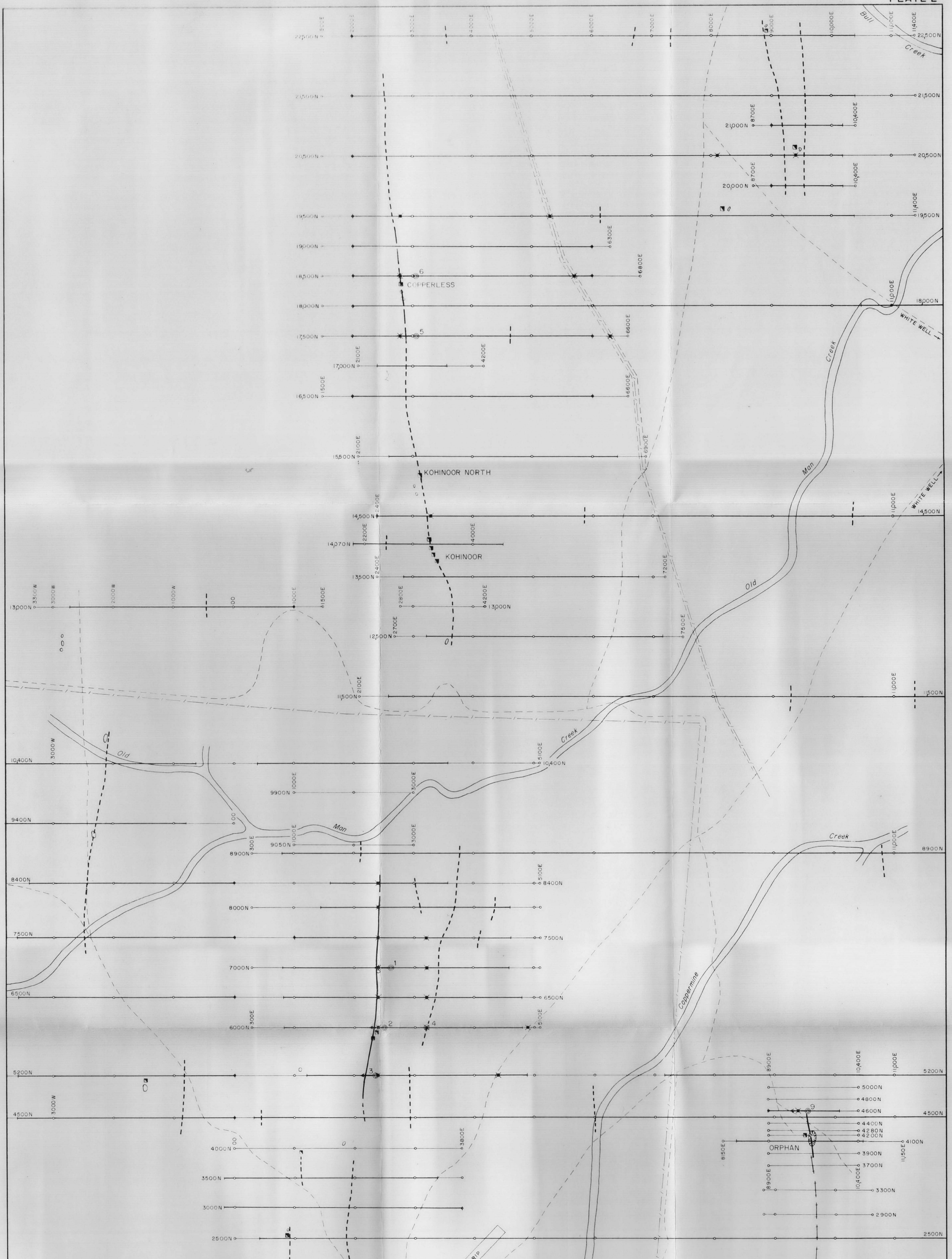


DOBBYN AREA, QUEENSLAND

LOCALITY MAP
AND GEOPHYSICAL GRID

TO ACCOMPANY RECORD No. 1968/72

E54/B7-28-1



LEGEND

- Geophysical traverse
- Traverse surveyed with IP
- Road or track
- Shaft
- Open cut
- Workings
- Fence
- Railway (dismantled)
- Permanent mark (steel peg in concrete)
- Recommended drill hole (*See plates 3, 4 and 5 for location of holes actually drilled.*)
- strong / medium / weak — IP metal factor anomaly

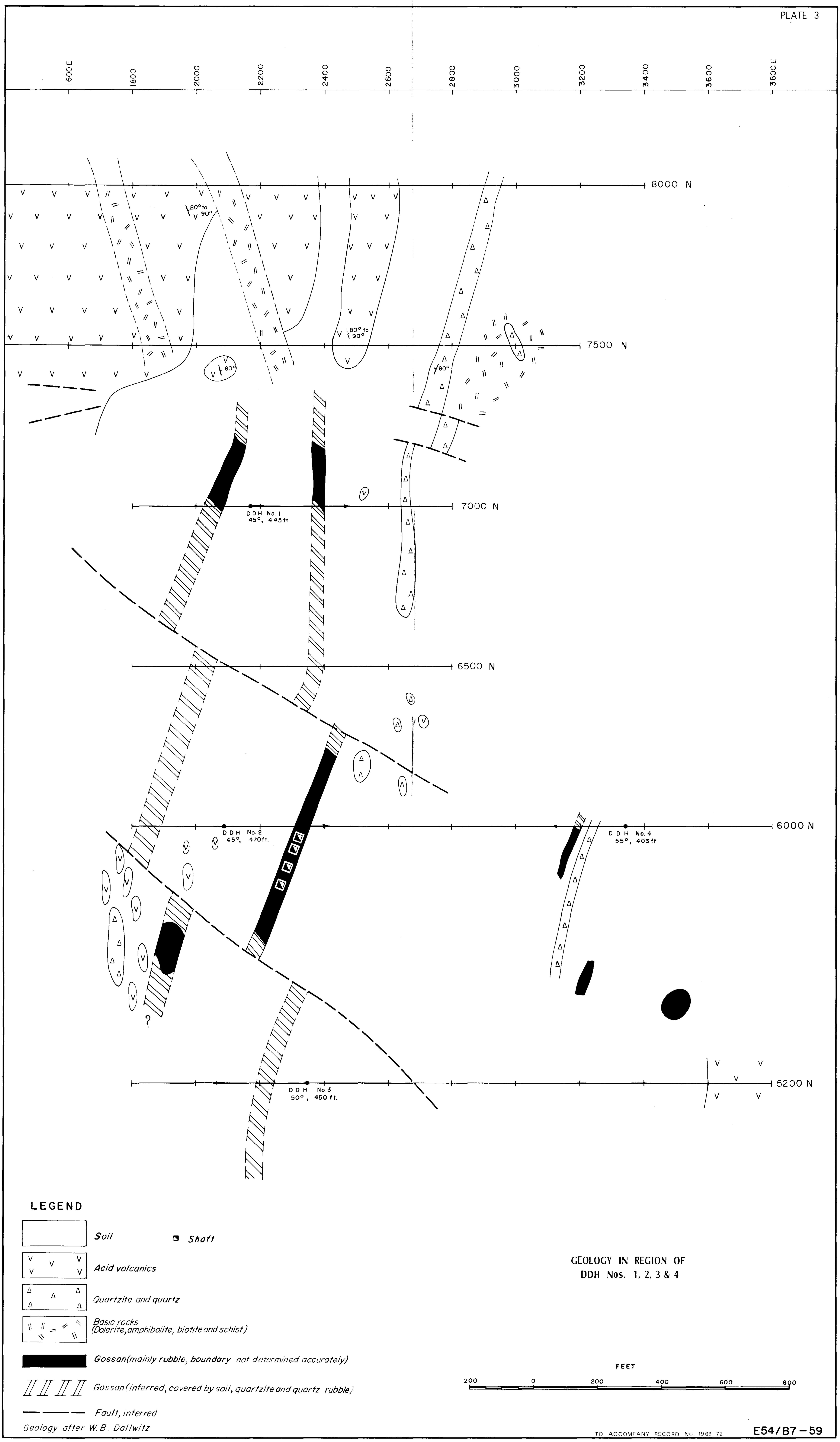
5°50'
MN TN

FEET
1000 500 0 1000 2000 3000

GEOPHYSICAL RESULTS DOBBYN, KOHINOOR, AND ORPHAN MINE AREAS

TO ACCOMPANY RECORD No. 1968/72

E54/B7-29-1



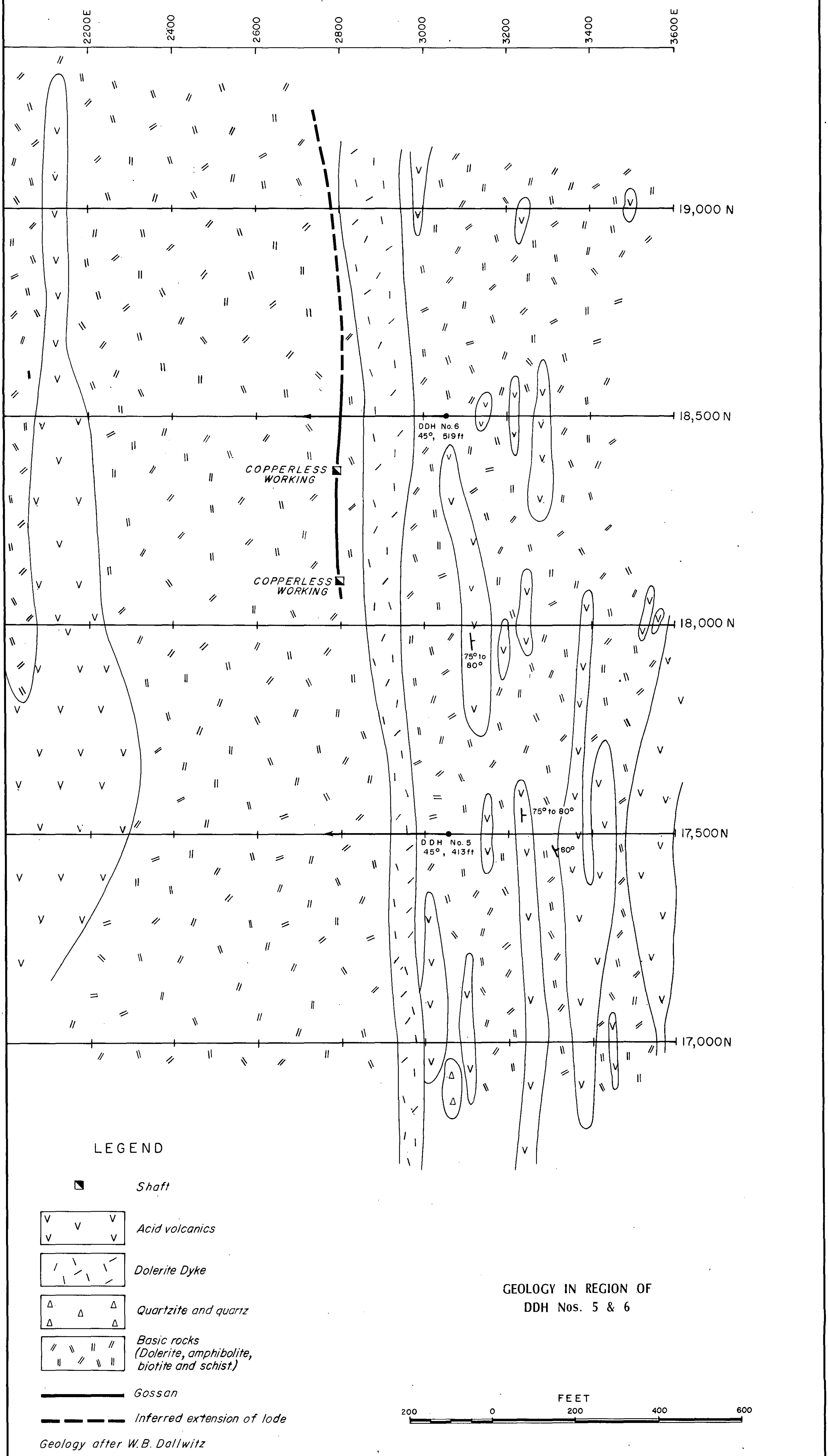
GEOLOGY IN REGION OF
DDH Nos. 1, 2, 3 & 4

Geology after W. B. Dallwitz

TO ACCOMPANY RECORD No. 1968/72

E54/B7-59

PLATE 4



GEOLOGY IN REGION OF
DDH Nos. 5 & 6

TO ACCOMPANY RECORD No. 1968/72

E54/B7-60

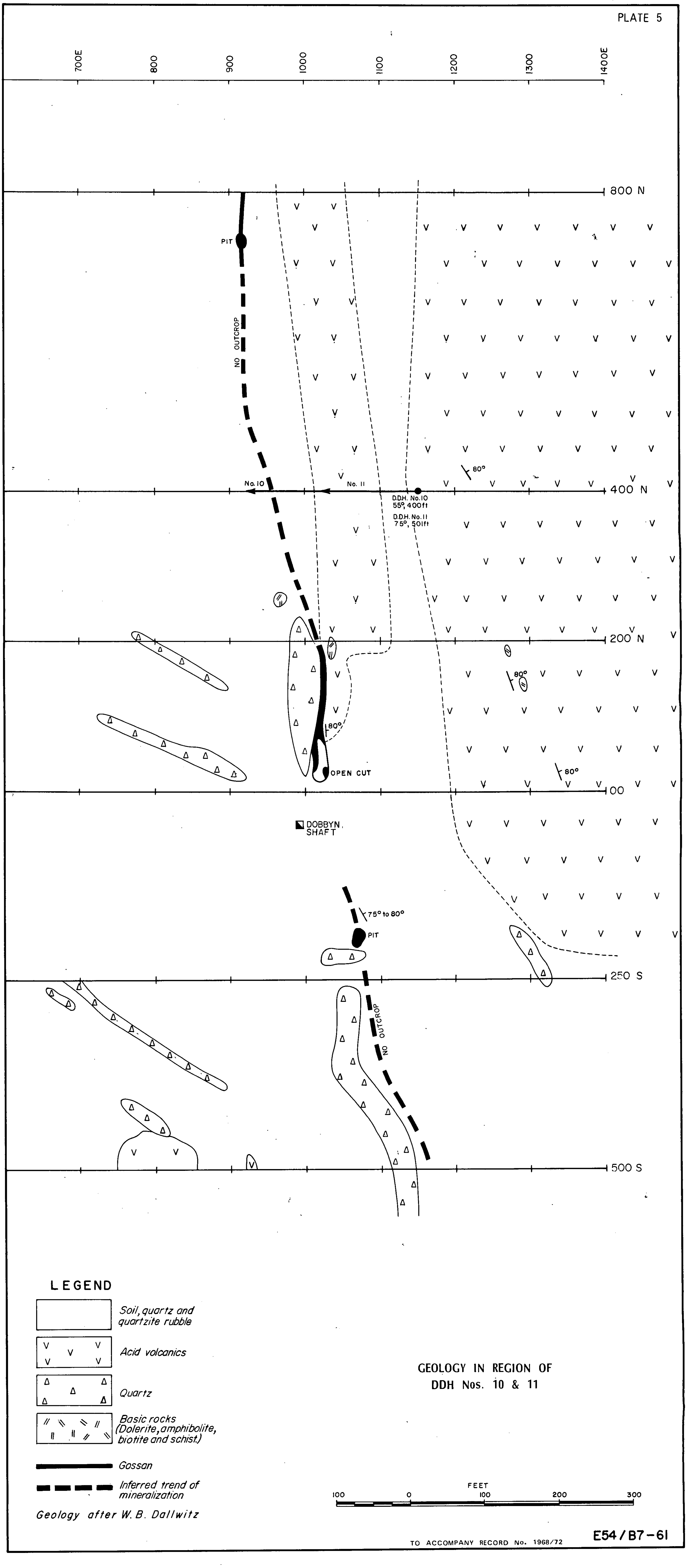
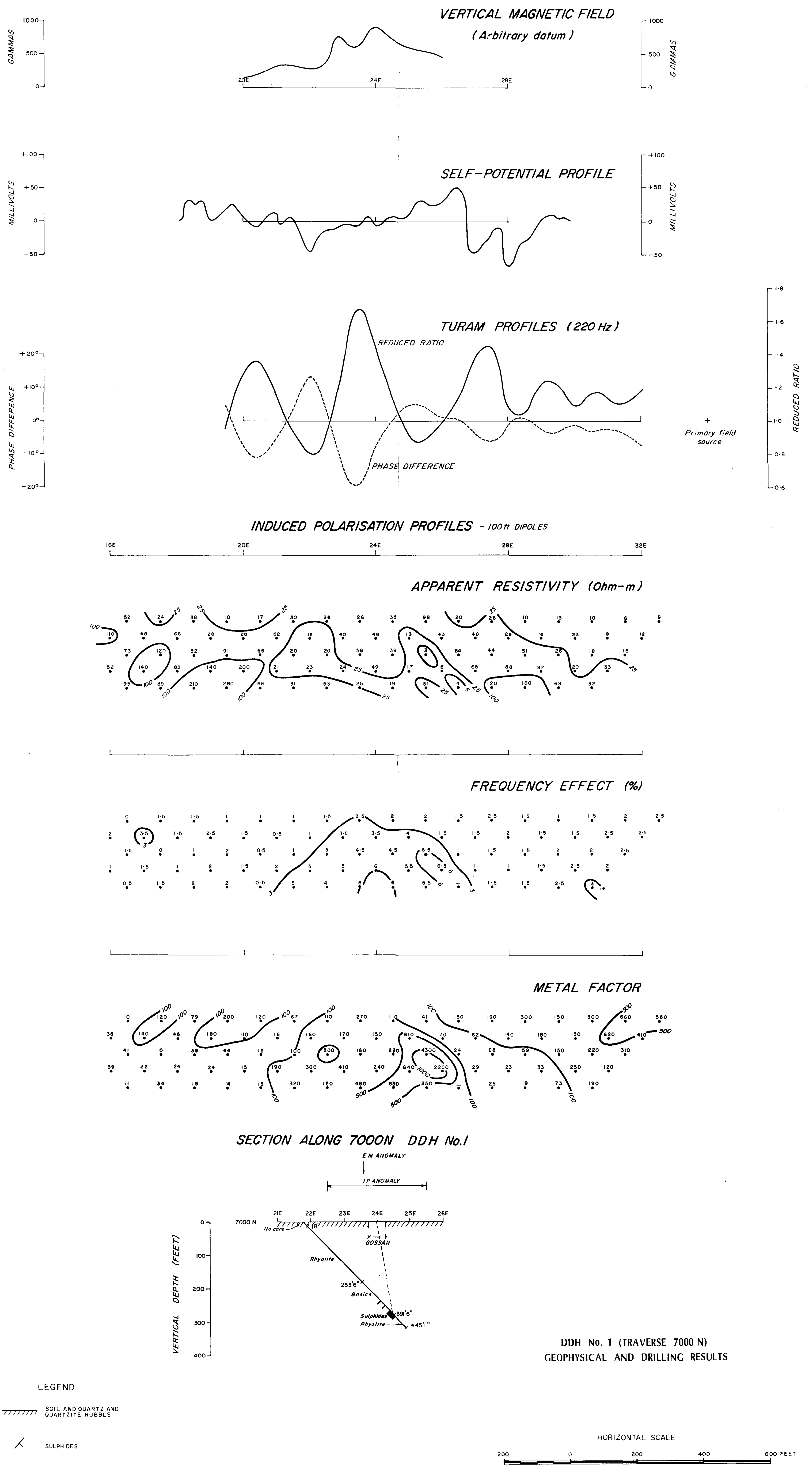
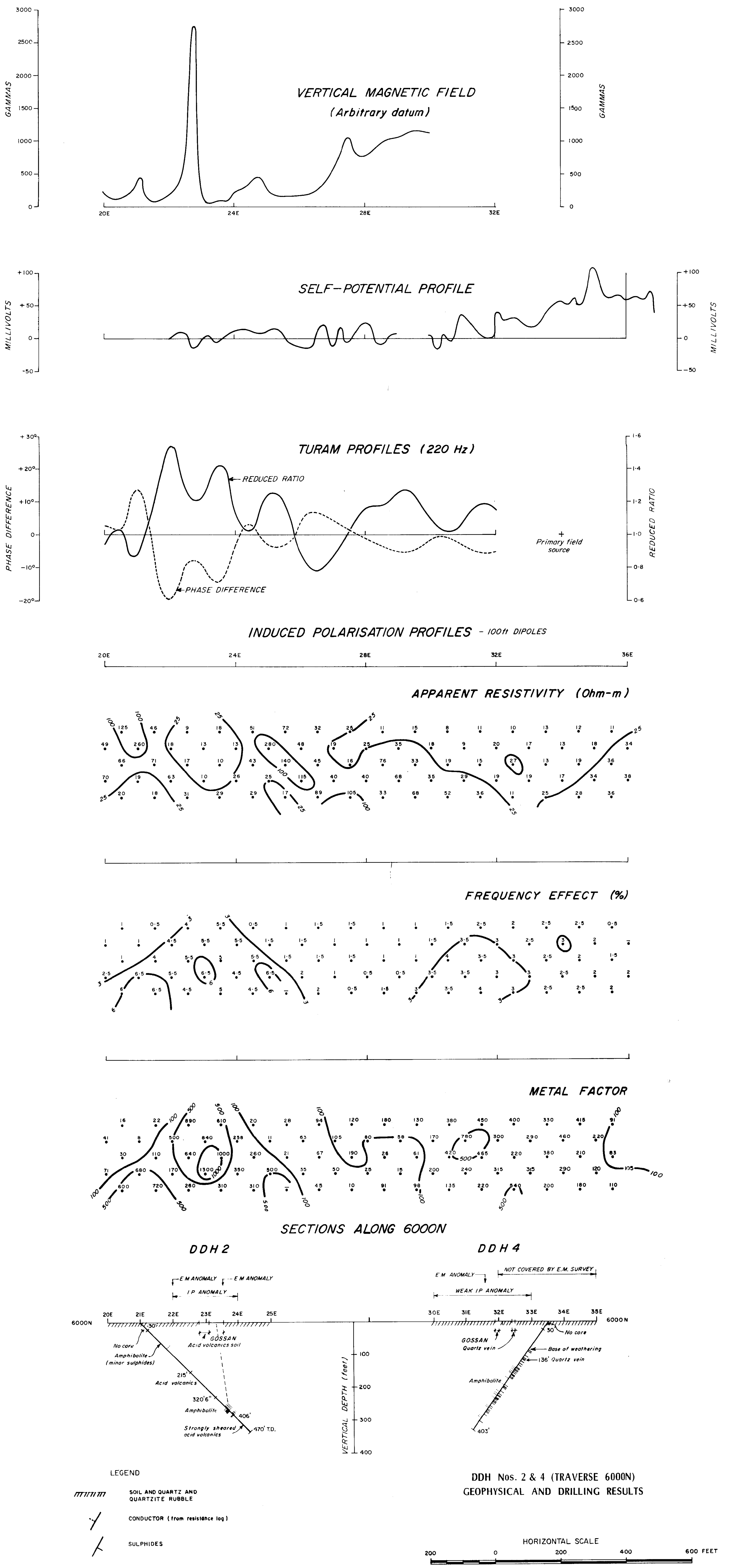


PLATE 5
700E
800
900
1000
1100
1200
1300
1400E
800 N
400 N
200 N
00
250 S
500 S
PIT
NO OUTCROP
No. 10
No. 11
DDH. No.10
55°, 400ft
DDH. No.11
75°, 501ft
80°
OPEN CUT
DOBBYN SHAFT
75° to 80°
LEGEND
Soil, quartz and quartzite rubble
Acid volcanics
Quartz
Basic rocks (Dolerite, amphibolite, biotite and schist)
Gossan
Inferred trend of mineralization
Geology after W. B. Dallwitz
FEET
100
0
100
200
300
GEOLOGY IN REGION OF
DDH Nos. 10 & 11
TO ACCOMPANY RECORD No. 1968/72
E54/B7-61



DDH No. 1 (TRAVERSE 7000 N)
GEOPHYSICAL AND DRILLING RESULTS

PLATE 7

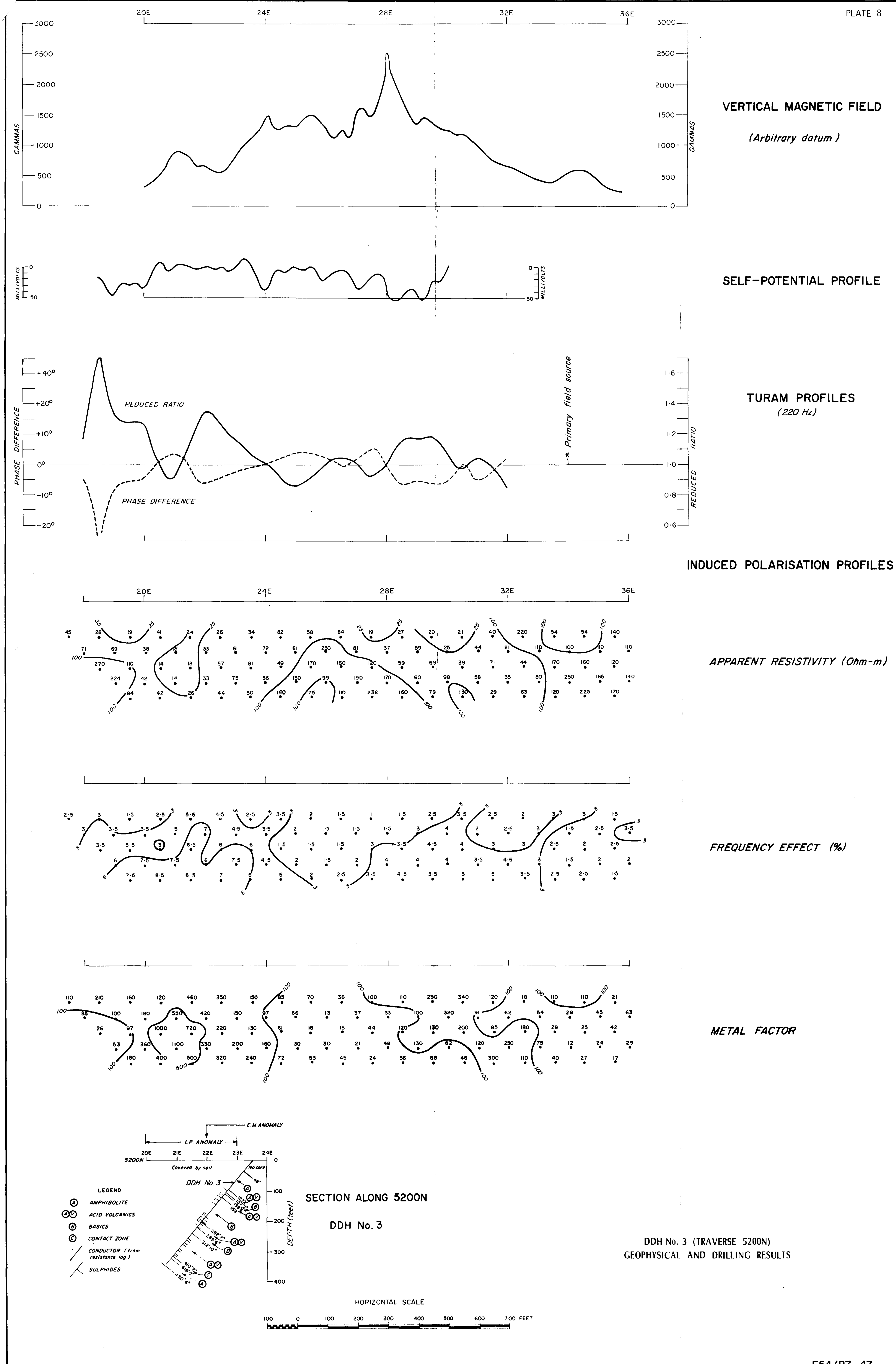


DDH Nos. 2 & 4 (TRAVERSE 6000N)
GEOPHYSICAL AND DRILLING RESULTS

TO ACCOMPANY RECORD No. 1968/72

E54/B7-55

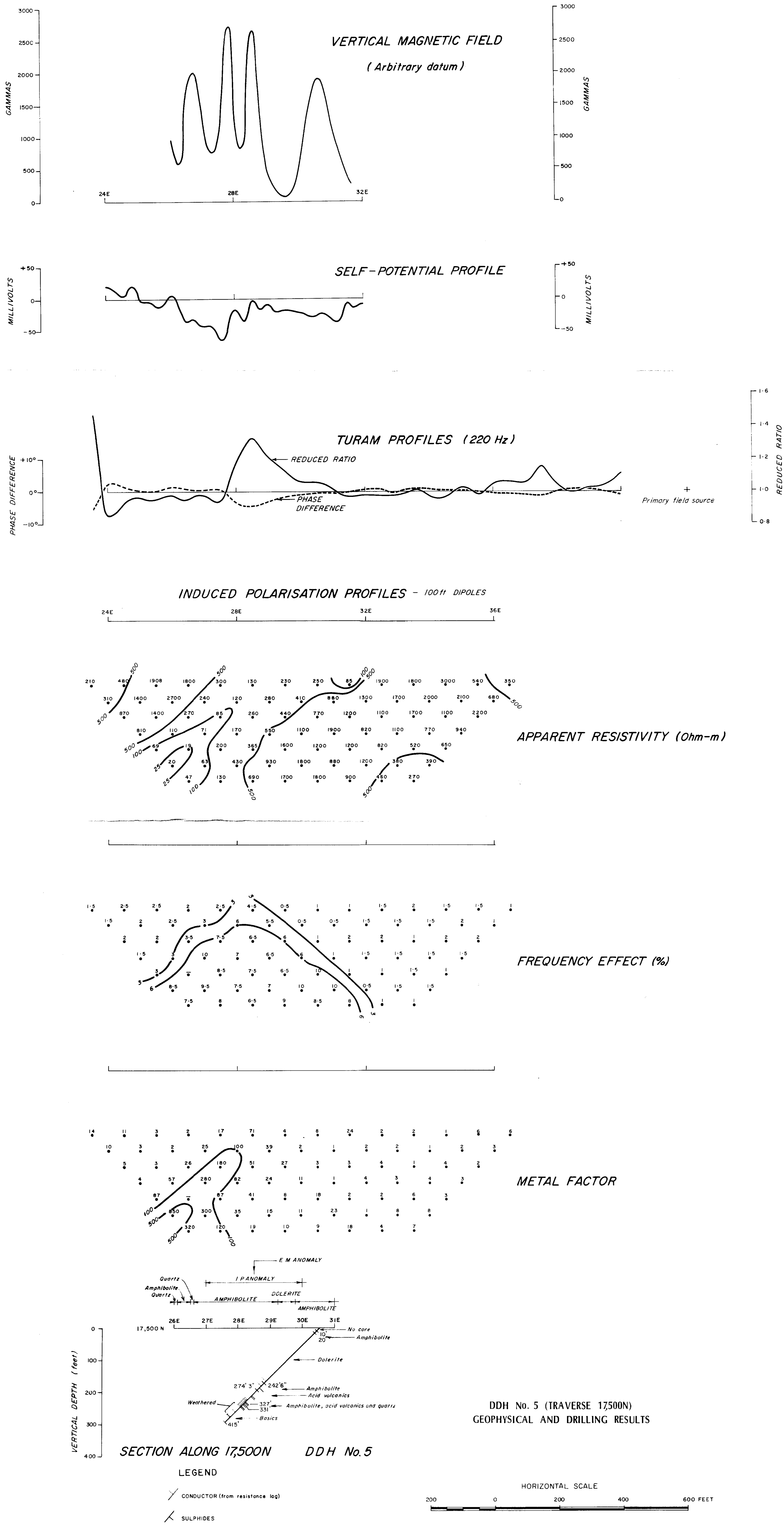
PLATE 8



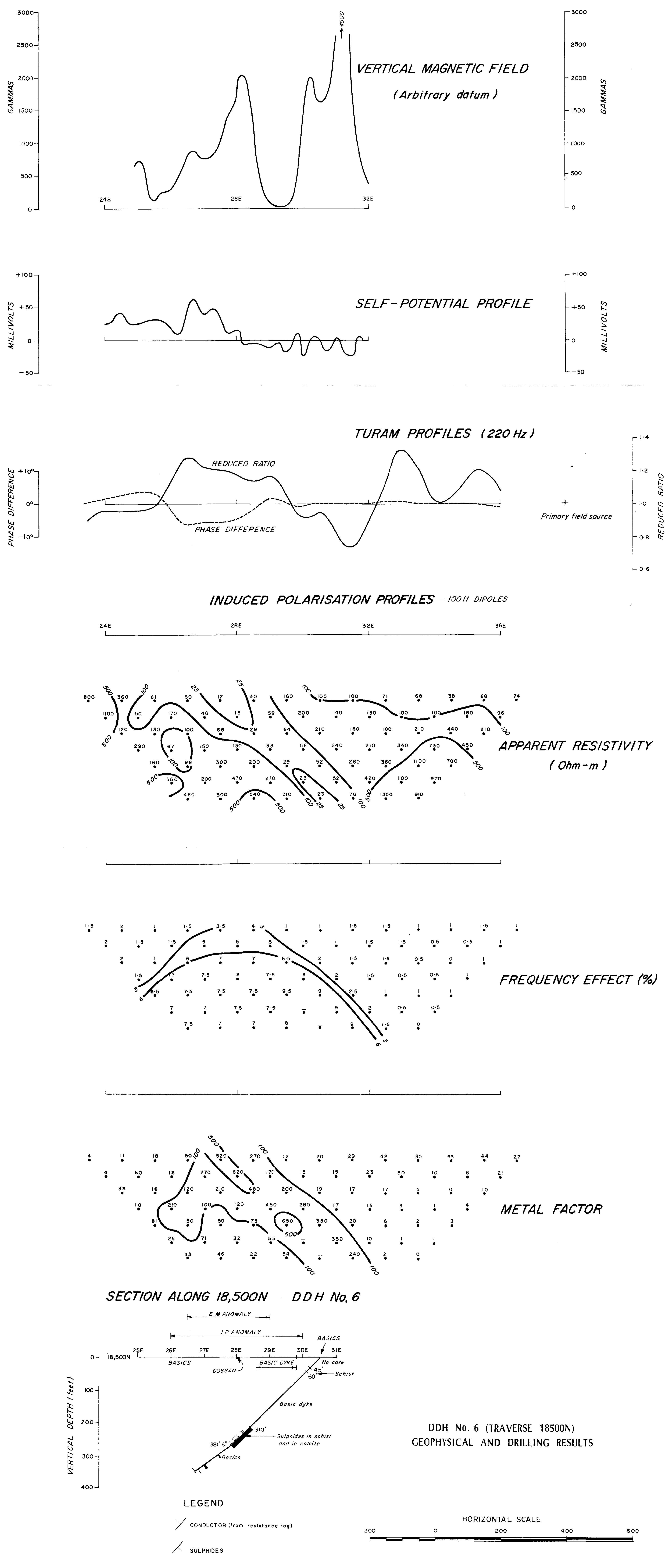
DDH No. 3 (TRAVERSE 5200N)
GEOPHYSICAL AND DRILLING RESULTS

TO ACCOMPANY RECORD No. 1968/72

E54/B7-47

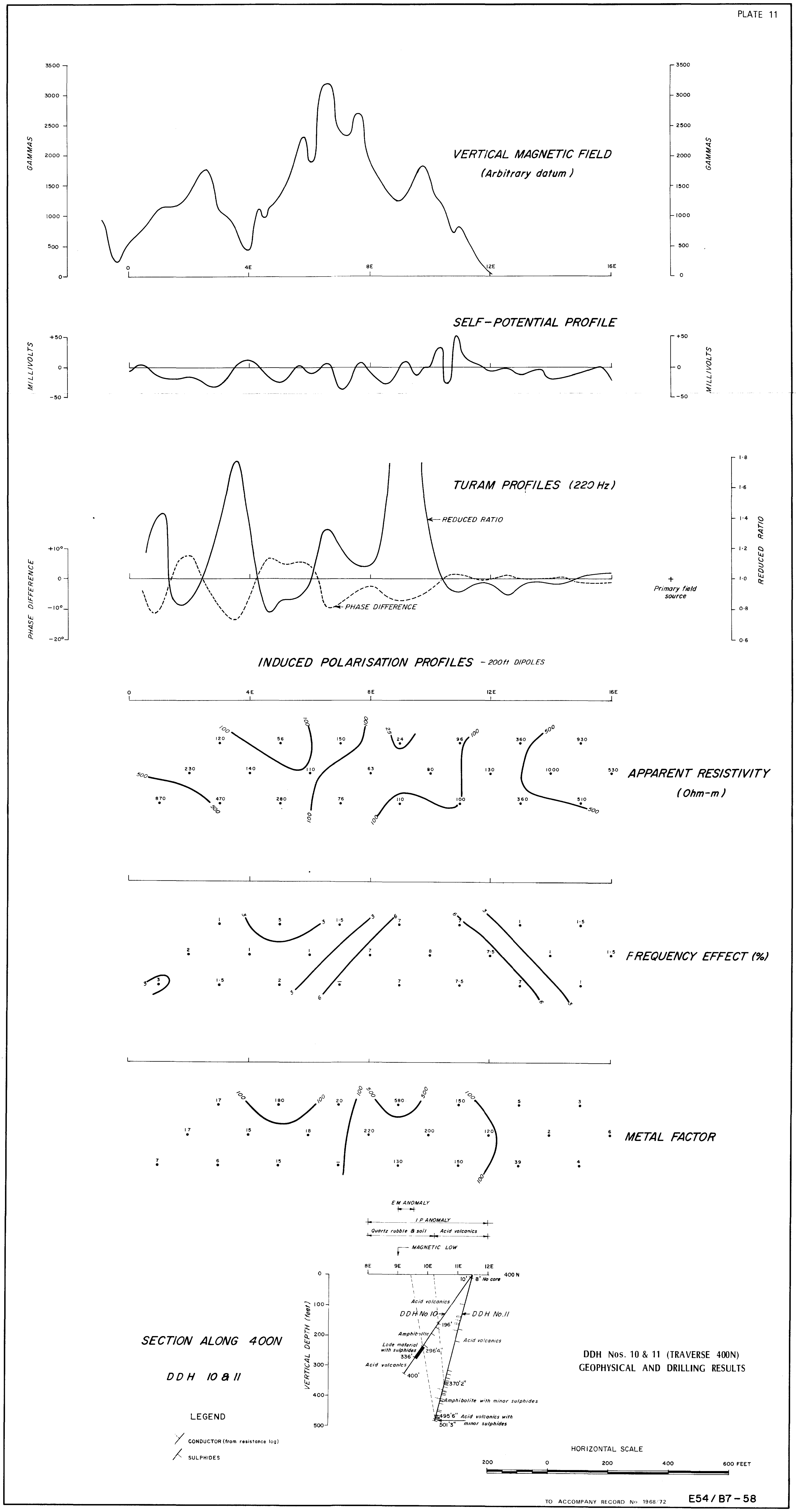


DDH No. 5 (TRAVERSE 17,500N)
GEOPHYSICAL AND DRILLING RESULTS



DDH No. 6 (TRAVERSE 18500N)
GEOPHYSICAL AND DRILLING RESULTS

DOBBYN QLD 1967



DOBBYN QLD 1967

DDH No. 3
ELECTRIC LOGGING RESULTS

TO ACCOMPANY RECORD No. 1968/72

E 54/B7-76

PLATE 12